GROUNDWATER ASSESSMENT DEMONSTRATION REPORT

FOR

MITCHELL PLANT

Groundwater Assessment Demonstration Report

for

Operating Company: Ohio Power Company

Facility: Mitchell Plant

Location: Moundsville, West Virginia

I hereby certify that I have examined data regarding the facility and, being familiar with the provisions of 40 CFR, Part 265.9, I attest that this Groundwater Assessment Demonstration Report has been prepared in accordance with good engineering practices.

Robert Haag, Geologist
Printed name of qualified geologist or geotechnical engineer

Robert D. [illegible]
Signature of qualified geologist or geotechnical engineer

Date 11/11/81

Designated person accountable for RCRA activities at this facility:

Name and Title M. A. Dean, Plant Chemist

Designated Company Contact:

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Facility: Mitchell Plant

Table of Contents

I. Statement of Facility Policy and Objectives

Through safe and conscientious handling of on-site hazardous wastes regulated under the Resource Conservation and Recovery Act (RCRA), this facility is committed to preventing contamination of groundwaters. Toward that end, this document has been prepared to: 1) examine hazardous waste(s) managed on-site and/or discharged to on-site impoundment(s), 2) examine potential(s) for those hazardous waste(s) to migrate via the uppermost aquifer to water supply wells or to surface waters, and 3) to determine if installation, operation and maintenance of an on-site groundwater monitoring system is necessary.

This Groundwater Assessment Demonstration Report satisfies the written requirements set forth in 40 CFR, Part 265.90, paragraph (c). At a minimum this report, which will be kept at the facility, addresses the following items:

1) The hazardous wastes handled at this facility
2) The potential for migration of hazardous waste or hazardous waste constituents from the facility to the uppermost aquifer, by an evaluation of:
   a) a water balance of precipitation, evapotranspiration, runoff, and infiltration, and
   b) unsaturated zone characteristics (i.e., geologic materials, physical properties, and depth to groundwater), and
   c) the potential for hazardous waste or hazardous waste constituents which enter the uppermost aquifer to migrate to a water supply well or surface water, by an evaluation of:

i) saturated zone characteristics (i.e., geologic materials, physical properties, and rate of groundwater flow), and

ii) the proximity of the facility to water supply wells or surface water.

If this Demonstration Report, when completed, shows that groundwater monitoring is not necessary, then the report will be kept available during interim status and provided to the Regional Administrator upon his request. Should the completed Report show that groundwater monitoring is necessary, then the Report will serve as the rationale for monitoring well placements. If shown to be necessary, groundwater monitoring must begin by November 19, 1981; a groundwater sampling and analysis plan would have to be prepared by that same date, as would an outline of a groundwater quality assessment program. These additional requirements are mentioned here only for informational purposes. The primary objectives of this Groundwater Assessment Demonstration Report are as already given in the first paragraph of this section.

II. Operational Description of the Facility and the Hazardous Wastes Handled On-Site

A. Operational Facility Description and Layout

A brief description of this Plant's generating capability and general site layout is given below. An abbreviated plot plan is attached to assist the reader in visualizing the facility layout.

Throughout this Report additional pages will be added as necessary and will be designated by the original page number followed by A, B, C, etc.

The Mitchell Plant is located near Moundsville, West Virginia on the Hannibal Pool of the Ohio River at River Mile 112.3 (measured downstream from Pittsburgh, PA). The Mitchell Plant consists of two coal-fired electric generating units, each rated at 800 MW; both units were placed into commercial operation on May 31, 1971. Both units are equipped with electrostatic precipitators. Condenser cooling for both units is provided by a closed-cycle recirculating cooling water system with each unit equipped with a hyperbolic natural draft cooling tower. Bottom ash, pyrites, and fly ash are sluiced to an on-site storage area.

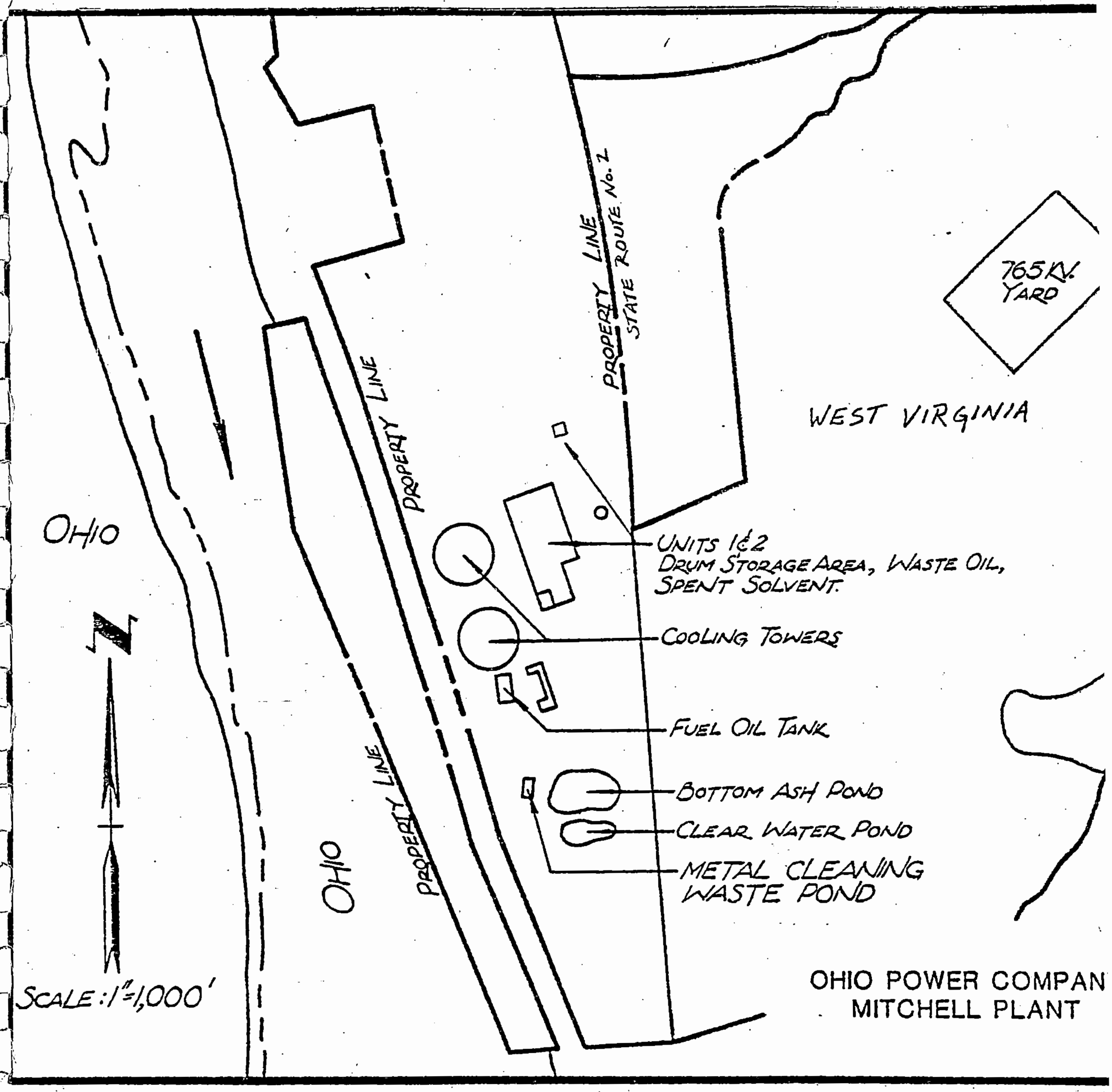
A RCRA permit application (Part A) was filed for the plant by Ohio Power's November 17, 1980 transmittal to U.S. EPA (EPA ID No. WVT000621995). Hazardous wastes handled on site will be more fully described in Parts II.B and II.C. of this report, but they consist of metal cleaning wastes and waste solvents. Metal cleaning wastes, resulting from the chemical cleaning of the waterside of the steam

II.A. Operational Facility Description and Layout, cont'd.

generator tubes, are discharged to an on-site treatment basin where chemicals may be added to provide neutralization, precipitation, and sedimentation. This metal cleaning waste basin is located adjacent to and west of the bottom ash pond. Waste solvents are stored in containers for less than 90 days in compliance with Section 264.34 and are periodically mixed with coal for subsequent burning in the utility boilers for the recoverable energy value of these waste solvents. The waste solvent storage area along with the metal cleaning waste basin are shown on the abbreviated plot plan which follows.

Abbreviated Plot Plan

Scale: 1" = 1000'



II.B. Listing of Hazardous Wastes Handled On-Site by Methods Other than Surface Impoundment

No.

Listed below are the hazardous wastes managed on-site by methods other than surface impoundment. Measures taken to assure that this group of hazardous wastes do not impact groundwater are given. For example, periodic inspection of a barrel stored on curbed asphalt and containing a hazardous waste solvent provides assurance that groundwater is not being impacted.

Hazardous Wastes	Measures Taken
√ Trichloroethane (F001) Methanol (F005) √ Toluene (F005)	The waste solvents, trichloroethane, methanol, and toluene are stored in 55-gallon drums for less than 90 days and are periodically mixed with the coal for subsequent burning in the utility boilers for the recoverable energy value of these waste solvents. The waste solvent storage areas are inspected weekly for any signs of container deterioration and "weeping". Such measures ensure that these wastes do not impact groundwater.

II.B. Listing of Hazardous Wastes Handled On-Site by Methods Other than Surface Impoundment, cont'd.

Hazardous Wastes	Measures Taken
	(please continue with the next page)

II.C. Listing of Hazardous Wastes Managed On-Site By Surface Impoundment

Listed below are the hazardous wastes managed on-site by surface impoundment. Also provided is a column which explains how the waste was produced, what form of treatment (if any) is provided, and what chemical reactions are anticipated. Estimates of the detention times are provided as well as a description of the ultimate disposition.

Hazardous Wastes	Discussion
Metal Cleaning Wastes (D007)	Periodically, it is necessary to chemically clean the waterside of the steam generator tubes within the plant. A 3% hydroxy-acetic formic acid solution is used to clean both Mitchell units. After cleaning, the spent acid solution is discharged to an on-site metal cleaning waste basin. Lime and caustic are added to elevate the solution pH. By raising the pH, both the solubility of iron and copper and other metals is greatly reduced allowing these metals to precipitate out to the bottom of the basin. Neutralization occurs quickly, and the waste is rendered non-hazardous in a brief period of time. Prior to the addition of lime and caustic to elevate pH and precipitate metals, generally the metal cleaning waste is a hazardous waste

II.C. Listing of Hazardous Wastes Managed On-Site By Surface Impoundment, cont'd.

Hazardous Wastes	Discussion
	solely due to total chromium concentrations exceeding 5.0 mg/l. However, depending on the condition of the tube metal being cleaned, total chromium may not exceed the criterion for chromium toxicity. For example, a waste sample taken during an April 13, 1981 metal cleaning job at another similar plant showed that particular waste was non-hazardous with a total chromium concentration of 4.0 mg/l. An analysis of the same sample for hexavalent chromium concentration showed less than 0.100 mg/l. If the rule proposed in the October 30, 1980 Federal Register becomes final (the rule to change the chromium toxicity criterion from total chromium to hexavalent chromium), then the Company would not be handling a hazardous metal cleaning waste at all. More specifically, we know that the Mitchell Plant metal cleaning waste cannot be classified as a waste which is: a) reactive, b) ignitable, c) corrosive, by low or high pH or by corrosion

II.C. Listing of Hazardous Wastes Managed On-Site By Surface Impoundment, cont'd.

Hazardous Wastes	Discussion
	rate,
	d) toxic, except when the total chromium concentration exceeds 5.0 mg/l, and
	e) a listed hazardous waste.
	The neutralized solution is held in the metal cleaning waste basin until samples analyzed indicate that iron and copper concentrations have been reduced to below 1 mg/l (for NPDES purposes) and the total chromium concentration below 5 mg/l (for RCRA purposes). Ultimately, the treated solution is discharged to the bottom ash pond for additional neutralization. The metal cleaning waste basin measures approximately 200 feet by 75 feet with a design capacity of approximately 326,000 gallons and is located adjacent to and west of the bottom ash pond. A liner was provided for groundwater protection and consists of two layers of 20 mil PVC liner with a three-foot cover of clay.
	A closure plan, as dictated by RCRA, has been prepared outlining procedures to be followed to

II.C. Listing of Hazardous Wastes Managed On-Site By Surface Impoundment, cont'd.

Hazardous Wastes	Discussion
	ensure an environmentally safe closeout of the basin. The plan includes the removal of any hazardous sludge, backfilling, the addition of top soil, and reseeding. It should be pointed out that a MCW basin sludge sample grabbed from a similar basin was analyzed by EP toxicity test and found to be below the EPA toxicity criteria by at least one order of magnitude and usually two orders of magnitude. We have theorized that the precipitated chromium is now in the form of a relatively stable compound, and the chromium is not leached during the Extraction Procedure test.

III. Geological and Hydrological Description of the Facility

This section presents data gathered from various sources regarding the geologic and hydrologic makeup of the site and surrounding area.

III.A. Identification of Regional Flow Systems and Water Supply Sources in the Area

There are two principal sources of potable groundwater in the Mitchell Plant vicinity:

1) the Pleistocene-aged valley-fill of the Ohio River and

2) the Pennsylvanian-aged Conemaugh group bedrock unit

What is essentially an extension of the Ohio River valley-fill may also be found in the valley of Fish Creek, immediately to the south of the plant site. Of the two types of aquifers, the valley-fill deposits are the more productive by far, capable of yielding over 1,000 gpm for wells which are near to the Ohio River, while the bedrock aquifers in this area may be expected to provide a maximum of 20 gpm, with an average yield more likely to be less than 5 gpm.

Ohio River Valley-Fill Aquifer. Prior to the Pleistocene, or "Ice Age", the drainage of the upper Ohio River region was strikingly different from its present-day configuration. The principal axes of drainage trended to the northwest, cutting channels roughly perpendicular to the present-day Ohio River. That Fish Creek, whose mouth is located just to the south of Mitchell Plant, belonged to this pre-glacial drainage system is illustrated by the fact that the bulk of the Fish Creek drainage points in the Ohio River's upstream direction, rather than joining the larger river pointing downstream, as is more typically the case in dendritic drainage patterns. However, the advance of glacial ice blocked these northwest-draining streams, and as their dammed channels filled and spilled over the valleys between them, a new drainage system which ran roughly parallel to the glacial front was created, and a precursor to the present-day Ohio River was born.

During a glacial retreat in the Pleistocene, sea level was lowered drastically, and the Ohio River cut a deep channel into its bedrock floor. A profile of the Ohio River deep bedrock channel (Carlston and Graeff, 1956) suggests, however, that at Fish Creek Island just south of the Mitchell Plant, the deep channel was cut in a different direction, as the bedrock surface rises beneath the island, and abruptly drops by 40 feet as the observer continues up the present-day stream toward the Mitchell Plant. This profile suggests that the vicinity of Fish Creek Island was a drainage divide for the late Pleistocene, rock-cut Ohio River. In a later glacial advance, these separate, deep, rock-cut channels were filled with a great volume of coarse sand and gravel. The continuous southwestward drainage of the Ohio River was apparently restored by the filling of the separate channels, and the only evidence of the prior drainage divide was the sharp rise in the deep-channel bottom in the vicinity of Fish Creek

Island. This bedrock rise causes the valley-fill in the Fish Creek Island vicinity to thin to less than 20 feet, whereas the fill rapidly returns to a thickness of 80-100 feet beneath the Mitchell Plant (Carlston and Graeff, 1956).

During the final glacial oscillations, the level of the Mississippi River was sharply raised, causing a backup of water on its largest tributary, the Ohio River. This period of slackwater led to the deposition of a thick blanket of silts and clays, which is widely observed to cap the basal sand and gravel fill of the Ohio River channel (Walker, 1957). This geologic setting leads to a basal sand and gravel aquifer which is unconfined if the groundwater table falls below the "capping" clays and silts, but an aquifer which is confined or seim-confined if the water table rises into the fine-grained deposits. The construction of the Hannibal Dam has raised the river level and the water table sufficiently to ensure that the latter condition is present at the Mitchell Plant today; however, the silty deposits are thinner and more pervious here than is the case farther downstream. Thus, conditions are generally likely to be semi-confined, with the phreatic surface located roughly at elevation 623, about 40 feet below the MCW basin bottom.

The configuration of the deep channel cut and the valley-fill deposits can be delineated quite clearly by observation of the valley walls, and by use of boring taken for the construction of the Mitchell

Plant. The cross-section shown in Figure 2 and located in map view on Figure 1, shows the valley configuration at the plant site. A similar section taken at Fish Creek Island would be expected to show a much shallower rock-cut channel, and a much thinner valley-fill deposit. The general setting of Fish Creek, and the Pleistocene terrace deposits mapped thereon (Cross and Schemel, 1956, Map II, Sheet 1), suggest that this creek may present a cross-section similar to that of the Ohio River at Mitchell Plant, but on a reduced scale. Thus, it seems likely that the Ohio River sand and gravel aquifer extends up Fish Creek for a certain distance.

Aquifer tests performed on five wells in the sand and gravel valley-fill aquifer at Round Bottom, about six miles upstream of the plant, and one well located roughly 10 miles downstream, indicate permeabilities ranging between 6,700 and 9,500 gpd/ft^2, with an average of 8,400 gpd/ft^2 (Carlston and Graeff, 1957).

* Gradient information for the plant site is not available, however, most studies of the Ohio River indicate that the natural potential surface is extremely flat, with slopes usually in the neighborhood of 0.001 ft/ft (Woodward-Clyde Consultants, 1976). Groundwater flow rates in the sand and gravel may thus be expected to be in the neighborhood of 1 to 10 ft/day. It is an axiom of groundwater hydrology in humid regions that groundwater sustains river baseflow, thus during non-flood periods the gradient will slope toward the

Figure 1

Plan View of Mitchell Plant Vicinity

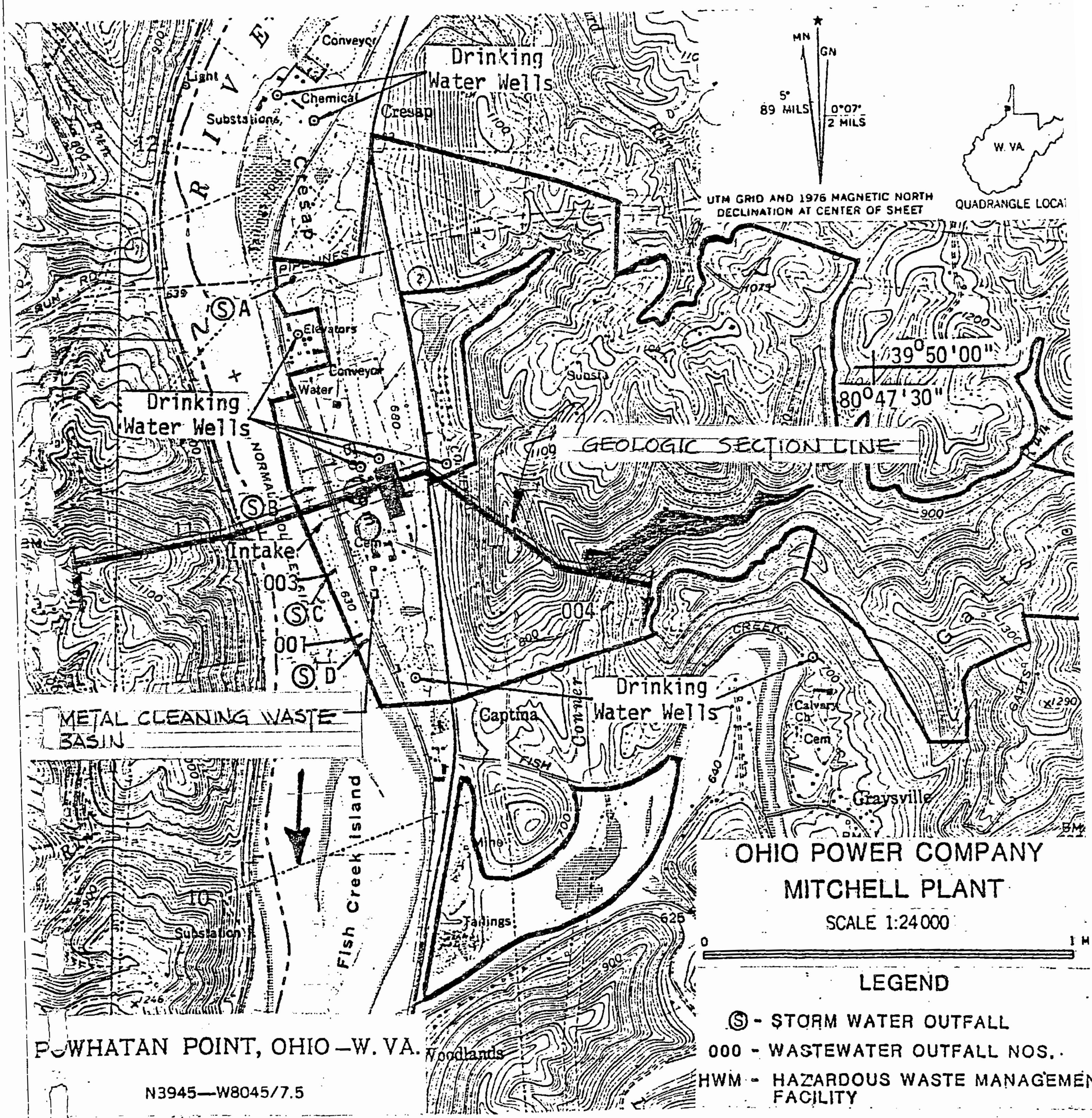


Figure 2

Geologic Cross Section of the Mitchell Plant Vicinity

(located in a pocket at the rear of this report) river, with a slight downriver component. Because subsurface flow is toward the river from either side, the river centerline acts as something of a "groundwater barrier". Water reaching this centerline from either side cannot continue in the same direction due to the oncoming, opposite flow, so the water must either recharge the river, or turn downstream below the river channel.

The locations of drinking water wells reaching the valley-fill aquifer are shown in Figure 1. Rather than analyze in detail the relationships between these wells and the metal cleaning waste pond, this study applies a simpler and more conservative approach: should the available data indicate that hazardous waste constituents would be likely to reach the valley-fill aquifer at any point, then either groundwater monitoring or pond improvement will be recommended.

Bedrock Aquifers. The bedrock units which crop out in the immediate vicinity of the Mitchell Plant are the lower Dunkard formation of Permian age, and the upper Monongahela formation of Pennsylvanian age. The Dunkard caps the hills above about elevation 800 while the Monongahela occupies an interval below that elevation (Woodward-Clyde Consultants, 1978). The Monongahela group is roughly 300 feet thick in this region, which would carry its base down to the neighborhood of elevation 500 near the plant. Borings indicate that the bottom of the deep, rock-cut channel of the Ohio River lies at about elevation 580 at the plant site, thus roughly 80-100 feet of the

Monongahela must extend below the bedrock channel, another roughly 100 feet of the unit is cut through by the channel, and the upper third of the Monongahela rises in the lower part of the hills above the valley. While this approximates the bedrock setting at the plant site, the gentle dip of the bedrock units to the SE causes the Ohio River bedrock channel to cut through a swath of different rocks in the reaches upstream and downstream of the plant. At the localized bedrock rise beneath Fish Creek Island (Carlston and Graeff, 1956) indicate that resistant sandstones, ranging from the lower Uniontown of Monongahela to the Mannington of the lower Dunkard, are cut by the river's bedrock channel.

Although this interval of the Monongahela and Dunkard rocks may contain numerous sandstones, neither unit is extensively developed for water-supply purposes in the Ohio-West Virginia region, due to the lateral variability of the sandstone beds. Wells fortunate enough to reach one of these variable sandstone units may provide a yield in the range of 5-15 gpm, but extensive rock aquifers are not considered to be present. Generally, the better yields obtained in the sandstone units of the Pennsylvanian-Permian strata are attributed to fracturing which is often best developed in these brittle rocks (Wilmoth, 1966). But in the vicinity of the Mitchell Plant, workers have noted that fracturing is best developed in the siltstones and shales (Woodward-Clyde Consultants, 1978).

III.A. Identification of Regional Flow Systems and Water Supply Sources in the Area (cont'd.)

Below the Monongahela lies the Conemaugh group, at an estimated depth below drainage of 100 to 200 feet. At such a depth, it is uncertain whether the sandstones of the unit will carry saline water. Wilmoth observes that salty groundwater is generally found in bedrock units below a depth of 300 feet, and sometimes less.

Interconnections. Numerous sandstone units of the upper Monongahela and lower Dunkard units appear to be cut by the bedrock channel of the Ohio River in the Mitchell Plant area. These sandstones are, therefore, likely to be in hydraulic connection with the basal sand and gravel aquifer which fills the Ohio River channel. The Monongahela and Dunkard sandstones are not exceptionally good aquifers, due to a lack of lateral continuity. Thus, lateral movement of water within these sandstones is not likely to be extensive. Some lateral movement of groundwater may be expected to take place via bedrock fractures in the zone of weathering, which will generally parallel the river.

III.B. Identification of Facility Position Within the Regional Flow System

As shown by Figures 1 and 2, the Mitchell Plant MCW treatment basin is located above the Ohio River valley-fill aquifer. The MCW pond was lined during construction with roughly three feet of clayey soils obtained from the vicinity, and with a two-layer synthetic liner (40 mils). A thickness of about five feet of silty sand caps the Ohio River valley-fill at this location, providing a slight additional barrier to separate the pond from the sand and gravel aquifer below.

III.C. Inspection of Water Losses from the Facility to the Regional Flow System and Conclusion on the Impact of Leakage to Water Supply Sources

Water which seeps from the MCW basin will travel downward at an extremely slow rate through the pond's clay lining to be barred by the synthetic liner below. This double liner system (natural clay plus two-layer PVC) should provide adequate protection against leakage of the temporarily impounded wastes toward water-supply sources.

IV. Concluding Statement Regarding the Necessity of Groundwater Monitoring Wells at This Facility

Before offering geotechnical conclusions on the need or lack of need for groundwater monitoring at this facility, characteristics of the metal cleaning wastes periodically impounded must be emphasized. Characteristics of these wastes are such that they soon may be exempt from the hazardous waste regulations. A U.S. EPA regulation proposed on October 30, 1980, if adopted, would provide a basis for delisting the waste from the permit application.

The metal cleaning wastes periodically handled at this facility are currently classified as hazardous wastes solely due to their total chromium concentrations. Sometimes analyses of these wastes show total chromium concentrations greater than the U.S. EPA criterion of 5.0 mg/l. Depending on the condition of the tube metal being cleaned, the total chromium concentration may be above or below the U.S. EPA limit.

Additional analyses of the metal cleaning wastes by the Company have shown that although the total chromium concentrations may be high (up to 15 mg/l), the hexavalent chromium concentrations are low. From four samples of hydroxyacetic formic acid metal cleaning waste sludges or supernatants analyzed for hexavalent chromium, none has been higher than <0.100 mg/l. As stated by U.S. EPA in their proposed rule of October 30, 1980, hexavalent chromium is the valence state of concern because of its carcinogenic toxicity. Recognizing this fact, U.S. EPA proposed to change the EP toxicity limit from total chromium (5.0 mg/l) to hexavalent chromium (5.0 mg/l). Should this rule become final, as we expect, the Company would no longer be

IV. Concluding Statement Regarding the Necessity of Groundwater Monitoring Wells at This Facility, cont'd.

handling a RCRA hazardous waste in a surface impoundment and would, therefore, be exempt from RCRA groundwater requirements. It is asked that the following geotechnical conclusion be considered in light of the potential change in regulations.

The clay and double-layer PVC liners installed in the Mitchell Plant MCW pond will effectively isolate the temporarily impounded wastes from the aquifer below, rendering monitoring wells unnecessary.

V. Review and Demonstration of How the Federal Guidelines on Required Contents of a Groundwater Assessment Demonstration Report Have Been Satisfied

Within earlier sections of this report, the Company addressed the potential for migration of hazardous waste or hazardous waste constituents from the facility to water supply wells (domestic, industrial, or agricultural) or to surface water. This material was presented in an order deemed most logical by the Company. Realizing that Federal or State inspectors may want to evaluate this report in light of Federal guidelines on report preparation, the following discussion is provided. Each section required by Federal guidelines (please see the May 19, 1980 Federal Register) is listed. A reference is provided to show where, in the Company's report, the required discussion can be found. In special cases where a discussion was not applicable for a facility, the abbreviation "NA" has been entered. Anytime "NA" is shown, a brief explanation follows.

Section Required by Federal Guidelines	Corresponding Reference in This Report
A. Evaluation of the Potential for Impounded Hazardous Wastes to Migrate to the Uppermost Aquifer	pages 12, 13A
1. Water Balance of Precipitation, Evapotranspiration, Runoff, and Infiltration	Please refer to the Appendix.

V. Review, cont'd.

Section Required by Federal Guidelines	Corresponding Reference in This Report
2. Characteristics of the Unsaturated Zone Underlying the Facility	pages 10B, 10C, 10E, 11
a. Geologic Materials	
b. Physical Properties	
c. Depth to Groundwater	pages 10B, 10E
B. Evaluation of the Potential for Impounded Hazardous Wastes Which Enter the Uppermost Aquifer to Migrate to a Water Supply Well or Surface Water	pages 12, 13A
1. Characteristics of the Saturated Zone Underlying the Facility	pages 10, 10A, 10C, 10E, 10F, 10G
a. Geologic Materials	
b. Physical Properties	
c. Rate of Groundwater Flow	
C. Proximity of the Facility to Water Supply Wells or Surface Water	pages 10C, 10D, 10F

Other comments or explanation of "NA" entries: ______________

References Cited

Carlston, C. W. and G. D. Graeff (1956) Geology and economic resources of the Ohio River Valley in West Virginia. Part III -- Groundwater Resources. West Virginia Geological Survey Volume XXII.

Cross, A. T. and M. P. Schemel (1956) Geology and economic resources of the Ohio Valley in West Virginia. Part I -- Geology. West Virginia Geological Survey Volume XXII.

Walker, E. H. (1957) The deep channel and alluvial deposits of the Ohio Valley in Kentucky. U.S. Geological Survey Professional Paper 1411. 25 pp. 2 maps, 15 cross sections, 1 profile.

Wilmoth, B. M. (1966) Groundwater in Mason and Putnam Counties, West Virginia Geological and Economic Survey Bulletin 32. 152 pp.

Woodward-Clyde Consultants (1976) Report on dam safety inspection, Mitchell fly ash dam and Mitchell bottom ash pond. Report to A.E.P. Service Corporation.

Woodward-Clyde Consultants (1978) Report on hydrogeologic study to establish alternate location for Aurora Township municipal well field. Report to A.E.P. Service Corporation 13 pp. tables and figures.

APPENDIX

to

Groundwater Assessment Demonstration Report for

Facility: Mitchell Plant

Water Balance of Precipitation, Evaporation, Runoff, and Infiltration

A water balance is a Federally required part of a Groundwater Assessment Demonstration Report. Since the subject was not addressed elsewhere in this Report, space is provided here for the necessary discussion.

A water balance has been computed for the metal cleaning waste treatment basin at this plant. It is essential to have this information when deciding whether or not to implement groundwater monitoring activities. Local precipitation, evaporation, surface runoff, and pond lining data have been considered while calculating the water balance, and these facts are described in this appendix.

Actual average yearly precipitation in the plant area, according to Climates of the States, which is compiled by the National Oceanic and Atmospheric Administration, is 41.3 inches. Ven Te Chow's Handbook of Applied Hydrology gives a value of 30.0 inches for average annual evaporation at the plant. Subtraction of evaporation from precipitation yields a net precipitation of 11.3 inches.

Since metal cleaning waste is deposited into a basin which is surrounded by dikes and constructed solely for the purpose of retaining the water until purified, this pond constitutes the entire drainage area affected by or affecting metal cleaning waste. The surface area of this pond is 0.35 acres.

The metal cleaning waste pond is fully lined with two 20 mil layers of PVC, with three feet of clay on top of it. There is no leakage, then, from the sides or bottom of the pond.

Water Balance of Precipitation, Evaporation, Runoff, and Infiltration, cont'd.

The overall water balance for the metal cleaning waste pond can be represented by this equation:

$$Q = P - E - I$$

where Q = surface runoff from pond

P = precipitation

E = lake evaporation

I = infiltration from pond

All parameters are average annual values and are computed over the surface area of the pond. Units are all acre-inches. Substituting actual values for the variables, we have:

$$Q = 14.5 - 10.5$$

$$= 4.0 \text{ acre-inches}$$

Since Q is a positive number, rainfall causes accumulation of water in the pond.

Appendix I

Literature Cited

Chow, Ven Te, Handbook of Applied Hydrology, McGraw-Hill, Inc., New York (1964).

National Oceanic and Atmospheric Administration, Climates of the States, Water Information Center, Port Washington (1974).

Other References

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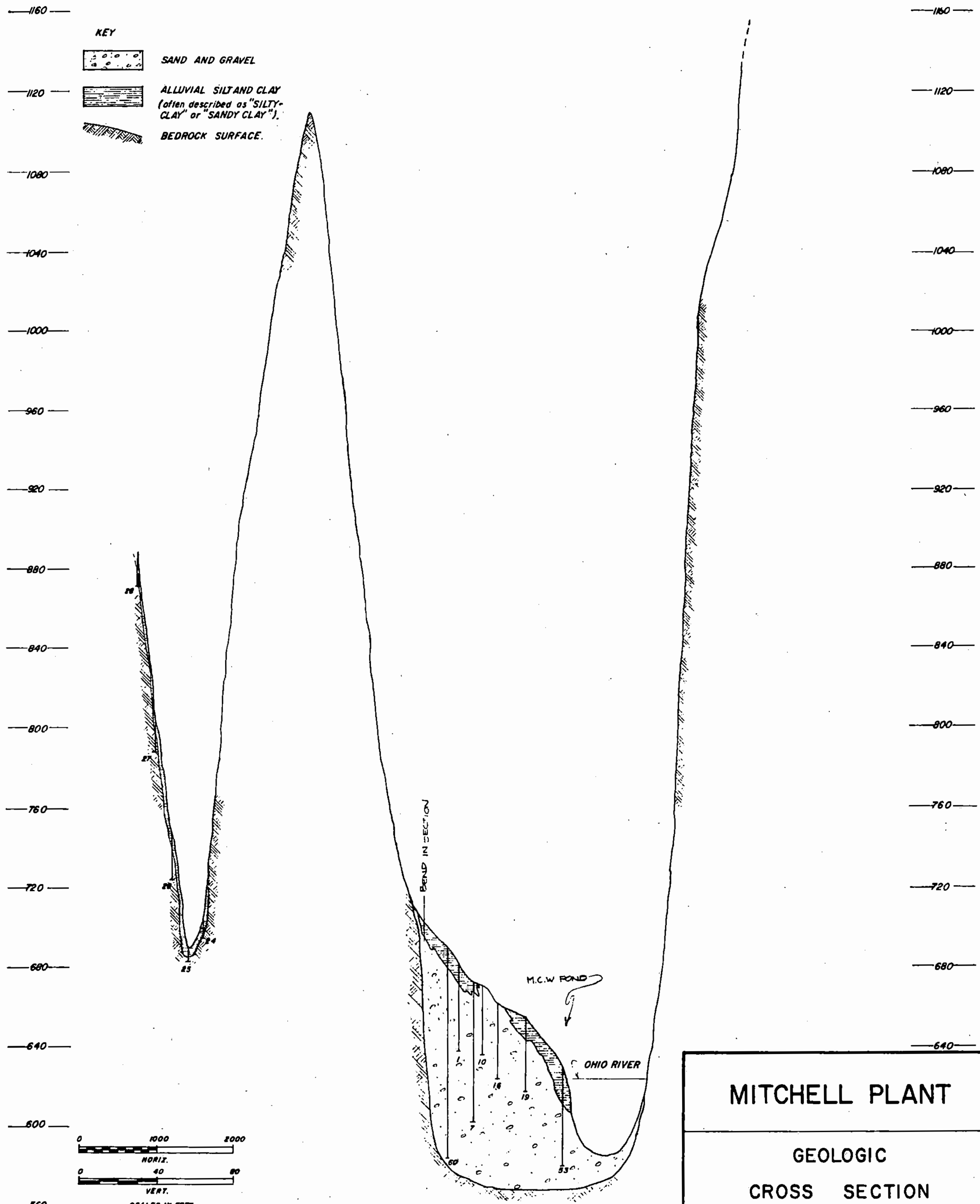
Webb, T. E., Internal Memorandum, "Water Balance for RCRA Groundwater Studies", (May 1, 1981).



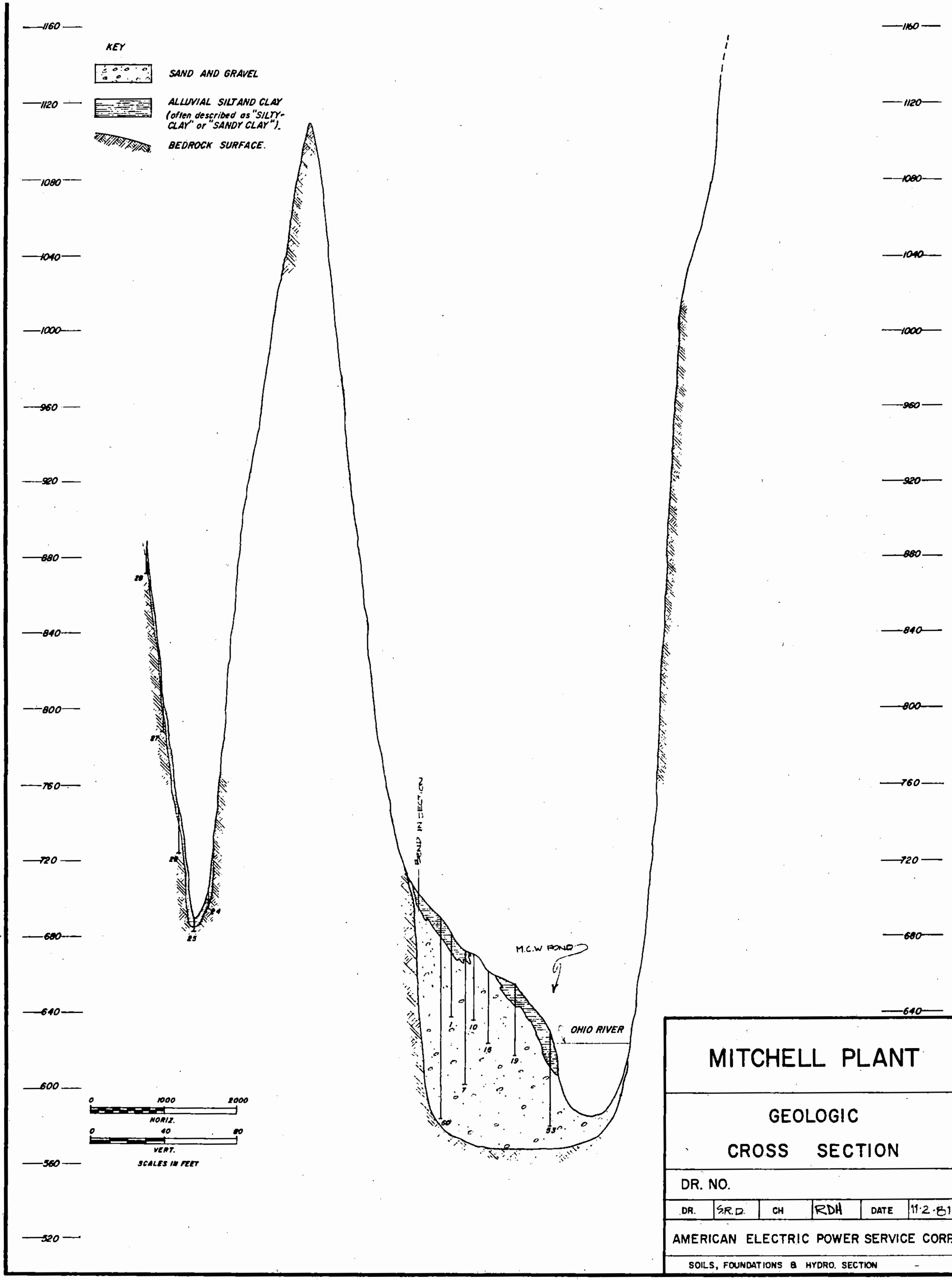
MITCHELL PLANT

GEOLOGIC CROSS SECTION

DR. NO.					
DR.	SRD	CH	RDH	DATE	11·2·81

AMERICAN ELECTRIC POWER SERVICE CORP.

SOILS, FOUNDATIONS & HYDRO. SECTION



MITCHELL PLANT

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